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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/754,151	01/09/2004	Andrey E. Yakshin	Q105440	7473

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EXAMINER	
BAND, MICHAEL A	

ART UNIT	PAPER NUMBER
1795	

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12/08/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/754,151	YAKSHIN ET AL.	
	Examiner	**Art Unit**	
	MICHAEL BAND	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 October 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3,6,8,10,12 and 14-17* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1 ,3, 6, 8, 10, 12, and 14-17* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 10/14/2008 has been entered.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kobayashi et al (US Patent No. 6,077,403) in view of Pinarbasi (US Patent No. 5,492,605).

With respect to claim 1, Kobayashi et al discloses a sputtering device allowing a film to be formed (abstract).Fig. 1 depicts a sputtering discharge gas [41], a valve [43], and a flux adjuster [44] to regulate the flow of the gas into a sputtering chamber [1]. Fig. 1 further depicts a distance between a target [2] and a substrate [50]. Kobayashi et al

further discusses the distance between the target [2] and substrate [5] is about 120 mm, with the mean free path about 5mm or less (i.e. smaller) (col. 3, lines 55-60). Kobayashi et al also discusses a barrier film (i.e. new layer) being deposited using the same target in a two stage deposition, where titanium is deposited using an argon gas followed by titanium being deposited using a nitrogen gas (col. 10, lines 34-40), leading to different process parameters being needed for the different (i.e. inert and reactive) gases. However Kobayashi et al is limited in that the mean free path being larger than the distance between the target and substrate is not suggested.

Pinarbasi teaches “an ion beam sputter deposition system and method for the fabrication of multilayered thin film structures” (abstract), and that using a magnetron sputter-deposition device for fabrication of thin film devices is well known in the art (col. 1, lines 17-19). Pinarbasi further discloses that during operation, a “vacuum chamber is maintained at an internal operation pressure on the order of 1×10^{-4} Torr by a vacuum pump” (col. 5, lines 1-3). Pinarbasi depicts fig. 2 having a target [23] and substrate [31], with a distance between the target and the substrate. Pinarbasi states that “the mean free path for both sputtered target ions and the backscattered neutral atoms generally is greater than the distance between the target and the substrate” (col. 5, lines 56-58). Pinarbasi cites the advantage of the greater mean free path as optimizing selected properties of each layer for single-layered or multilayered structures (abstract).

It would have been obvious to one of ordinary skill in the art to include a mean free path larger than the distance between substrate and target as taught in Pinarbasi

for the device of Kobayashi et al to gain the advantage of optimized layers for single-layered and multilayered structures.

With respect to claim 10, modified Kobayashi et al further discloses a substrate-biasing high frequency power source [81] that applies a high frequency voltage to the substrate [50] (col. 4, lines 19-21). In addition, modified Kobayashi et al discusses the distance between the target [2] and substrate [50] being 120 mm (col. 3, lines 55-56).

4. Claims 3, 8, 12, 15, and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Donohue et al (USPGPub 2003/0024808) in view of Telford (US Patent No. 5,643,633) and Toyoda et al (US Patent No. 5,709,958).

With respect to claim 3, Donohue et al'808 discloses a method of sputtering a layer from a target using Krypton as the sputtering gas at a pressure of less than 1 millitorr (abstract). Donohue et al further discloses that the distance from the target to the wafer (i.e. substrate) is 430 mm (i.e. 43 cm) (p.1, para 14). Donohue et al further states that the pressure is kept at 0.85 millitorr (i.e. approximately 0.1133 Pa) for the sputtering apparatus. Maintaining the pressure at 0.85 millitor and the distance from target to wafer at 430 mm would result in a pressure and distance product of approximately 4.87 cmPa, thus larger than 2.0 cmPa. Donohue et al further discloses "switching to Krypton enables lower pressure operation ~0.15 millitor" (i.e. 0.02 Pa) (p.1, para 17) of the sputtering apparatus while still keeping the distance between target and wafer at 430 mm. The product of this pressure and said distance is approximately 0.86 cmPa, thus smaller than 2.0 cmPa. However Donohue et al is limited in that while at least one layer is deposited, it does not specify if two or more layers are deposited.

Telford et al teaches a technique for a film deposited by chemical vapor deposition (abstract) by a method such as sputtering (col. 1, lines 45-47). Telford et al further teaches using a two-stage process, the first stage comprising a high pressure first stage, followed by a low pressure second stage (col. 7, lines 55-60). Telford et al lists the advantage of this two-stage pressure differential as overcoming a tendency of contamination that would exist between the two stages (col. 7, lines 60-63).

It would have been obvious to one of ordinary skill in the art to separate the vacuum chamber into two deposition parts of distinct pressures taught in Telford et al in the sputtering apparatus of Donohue et al to gain the advantage of decreasing the contamination that exists between the two deposition stages.

However modified Donohue et al is further limited in that while WSix is known to be absorptive in the EUV region, it is not suggested to deposit a material that is reflective in the EUV region.

Toyoda et al teaches an amorphous film formed on a substrate, where the amorphous film comprises a conductor layer (abstract). Toyoda et al further teaches that CVD as well as PVD methods may be used to deposit the conductor layer, with specified conductor layer materials are Si, WSi, MoSi, pure Al, an Al alloy, pure Cu, Cu alloy, W, Au, and Ag (col. 10, lines 2-8) known to exhibit absorptive and reflective properties in the EUV region.

Since the prior art of Toyoda et al recognizes the equivalency of WSi and MoSi in the field of depositing a layer via CVD and PVD, it would have been obvious to one of ordinary skill in the art to interchange WSi of Telford et al with the MoSi of Toyoda et al

as it is merely the selection of art recognized equivalents in the manufacture of semiconductor devices and one of ordinary skill would have a reasonable expectation of success in doing so.

With respect to claim 8, modified Donohue et al further depicts fig. 1 having a moving magnetron [1] and a magnet on either side of the magnetron (p. 1, para 13). As the magnet moves the magnetic field intensity is altered, thereby creating an unbalanced magnetron.

With respect to claim 12, modified Donohue et al further discloses that the substrate may be negatively biased for operation at low pressures (p. 1, para 6) using a power supply (p. 1, para 13). Donohue et al also states that the distance between the target to wafer (i.e. substrate) is 430 mm (i.e. 43 cm) (p. 1, para 14). Modified Donohue et al further states that using Krypton gas enables lower pressure operation of the apparatus (p 1, para 18).

With respect to claim 15, modified Donohue et al further discloses a plasma in proximity of the target (fig. 1, [2], [10]) confined by a magnetic field with a wafer (i.e. substrate) being biased by a power supply (p. 1, para 13). The voltage being applied to the target and plasma source is 135 volts (p. 1, para 14).

With respect to claim 17, modified Donohue et al further discloses the plasma source is a magnetron (p. 1, para 13; fig. 1, [1], [10]). The bias voltage being applied is 135 volts (p. 1, para 14).

5. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kobayashi et al (US Patent No. 6,077,403) and Pinarbasi (US Patent No. 5,492,605) as

applied to claim 1 above, and further in view of Gupta et al (*Vacuum Technology & Coating*).

With respect to claim 6, the references are cited as discussed for claim 1. However Kobayashi et al is limited in that while magnetron sputtering is disclosed and depicted, it is not specified whether the magnetron operates in an unbalanced mode.

Gupta teaches a method of sputtering a layer from a target utilizing sputtering gas (p. 4, para 2). Gupta further teaches using a moving magnetron (i.e. linear scanning) (p. 1, para 1). As the magnet moves the magnetic field intensity is altered, thereby creating an unbalanced magnetron. Gupta lists the advantages of using a Linearly Moving Magnetron (LMM) as exceptionally high uniformities and repeatabilities (p. 1, para 2 and 4; p. 3, para 3; p. 4, para 5; p. 5, para 1).

It would have been obvious to one of ordinary skill in the art to use the moving magnetron taught in Gupta as the magnetron in Kobayashi et al in order to gain the advantages of exceptionally high uniformities and repeatabilities.

6. Claims 14 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kobayashi et al (US Patent No. 6,077,403) and Pinarbasi (US Patent No. 5,492,605) as applied to claim 1 above, and further in view of Donohue et al (USPGPub 2003/0024808).

With respect to claims 14 and 16, the references are cited as discussed for claim 1. Modified Kobayashi et al further depicts in fig. 1 a plasma [P] in proximity of the target [2] with a magnetic field from magnets [71] in proximity of the target and plasma since it is expected that the magnetic field lines will extend uniformly to the target and substrate

since electrode [6] is composed of the same material as the target [2] (col. 7, lines 1-7), thus allowing magnetic field through. Modified Kobayashi et al also discusses biasing the substrate at -100 V (col. 4, lines 32-35), However Kobayashi et al is limited in that while a power is attached to the target in fig. 1, a specific voltage is not suggested.

Donohue et al teaches a sputtering RF/DC magnetron (p. 1, para 14) with a plasma in proximity of the target (fig. 1, [2], [10]) confined by a magnetic field with a wafer (i.e. substrate) being biased by a power supply (p. 1, para 13). Donohue et al further teaches the plasma source is a magnetron (p. 1, para 13; fig. 1, [1], [10]). The voltage being applied to the target and plasma source (i.e. surface to be etched bias voltage) is 135 volts (p. 1, para 14).

It would have been obvious to one of ordinary skill in the art to use the voltage of Donohue et alas the voltage in the circuit for Kobayashi et al since Kobayashi et al fails to disclose a specific voltage and since Donohue et al teaches such voltages are functional in such devices, one would have a reasonable expectation of success in using the voltages of Donohue et al in Kobayashi et al.

Response to Arguments

7. Applicant's arguments filed 10/14/2008 have been fully considered but they are not persuasive.

103 rejections

8. On p. 8-9, the Applicant argues that Pinarbasi does not teach changing any processing parameter during the deposition of a single layer. The Applicant further argues that neither Kobayashi et al nor Pinarbasi teach a two-stage process for the deposition of the same layer by the same target.

The Examiner respectfully disagrees. Pinarbasi teaches controlling the mass of the sputtering gas and the energy of the ion beam as a function of target material to provide a single-layered structure wherein selected properties of each layer (i.e. single-layered) are optimized (abstract). Thus during deposition of the single layer, the process parameters are changed to optimize the single-layered structure. With regard to the limitation of a two-stage deposition process using the same target, Kobayashi et al discloses a barrier film (i.e. new layer) being deposited using the same target in a two stage deposition, where titanium is deposited using an argon gas followed by titanium being deposited using a nitrogen gas (col. 10, lines 34-40), leading to different process parameters being needed for the different (i.e. inert and reactive) gases.

9. On p. 9-12, the Applicant argues that combining Donohue et al with Telford et al would not be obvious since Telford et al teaches a chemical vapor deposition (CVD) technique in addition to teaching away from using a physical vapor deposition (PVD) technique. The Applicant further argues that the pressures described in Telford et al are a higher range than the claimed limitations.

The Examiner respectfully disagrees. With regards to the combination of Donohue et al and Telford et al, while Telford et al does teach using CVD technique, Telford et al also discloses that it is known in the prior art to have two deposition parts of

distinct pressures in a (PVD) apparatus (col. 1, lines 45-49), with the advantage of using a two-stage process as limiting contamination between the different stages. In addition it has been held that disclosures in a reference must be evaluated for what they fairly teach one of ordinary skill in the art (See MPEP 2100). Therefore it would have been obvious to one of ordinary skill in the art to combine the teachings of Donohue et al and Telford et al. In addition it has been held that disclosures in a reference must be evaluated for what they fairly teach one of ordinary skill in the art. With regards to the pressures, Donohue et al is relied on for teaching pressures of 0.85 millitorr and ~0.15 millitorr of gas pressure in the vicinity of the substrate, with a source to substrate distance of 43 cm.

Conclusion

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. US Patent No. 6,897,140.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael Band whose telephone number is (571) 272-9815. The examiner can normally be reached on Mon-Fri, 8am-4pm, EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexa Neckel can be reached on (571) 272-1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

12. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for

published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/M. B./

Examiner, Art Unit 1795

/Alexa D. Neckel/

Supervisory Patent Examiner, Art Unit 1795